Strategies and Mechanisms
For Promoting
Cleaner Production
Investments
In Developing Countries

Profiting From Cleaner Production
Performing Net Present Value (NPV) Calculations
Strategies and Mechanisms for Promoting Cleaner Production in Developing Countries

Profiting From Cleaner Production

Performing Net Present Value (NPV) calculations
"Performing Net Present Value (NPV) Calculations"

Introduction

This handout provides instruction and examples for calculating Net Present Value (NPV), an indicator of profitability for an investment project.

A typical Cleaner Production project involves an initial investment (a cash outflow) that will reduce the annual operating costs of existing equipment and processes. This reduction in annual costs provides cash inflows in future years that payback the initial investment. The NPV calculation converts all of a project's expected future cash flows into their "present value", i.e., their value NOW, at the very beginning of the project. Then all of the present values are added together to calculate a single number that can characterise the overall value of the project to the company, i.e., the project's profitability.

NPV typically is calculated over a specific time period of interest, e.g., 3 year or 5 years. If the project NPV is greater than zero, the project is considered to be profitable over that time period. If the project NPV is less than zero, the project is considered to be NOT profitable over that time period.

Calculation Formulas

By definition, $NPV = \sum (PV_1 + PV_2 + \ldots + PV_n) - \text{Initial Investment Cost}$

where:
- $NPV_n$ = the Net Present Value of the project over $n$ years
- $PV_1$ through $PV_n$ = the cash flows from each project year (positive for cash inflows, negative for cash outflows).

The formula for calculating the Present Value for a cash flow in a particular year is:

$PV_n = FV_n \times PVF_{nd}$

where:
- $PV_n$ = the Present Value of the cash flow from year $n$
- $FV_n$ = the known Future Value of the project cash flow in year $n$
- $PVF_{nd}$ = a Present Value Factor for the year $(n)$ and the project discount rate $(d)$

Values of PVF have been calculated for various combinations of $n$ and $d$ and are organised on "Present Value Tables", where they can be looked up easily (a version has been included at the end of this instruction guide).

Preparation

Before doing the NPV calculation for a project, you will need the following information:

1) The initial investment cost
2) The future cash inflows or outflows (FV) expected to occur in each subsequent year of the project. Sometimes the future cash flows will be the same every year, and sometimes they will be irregular. Sometimes they will be all cash inflows, and sometimes a mix of inflows and outflows. It will vary from project to project.

3) The discount rate (d) for the company or the project. Some companies use an average discount rate for the analysis of all projects. Other companies may prefer slightly different discount rates for different projects. The discount rate you use should be equal to the required rate of return for the investment project, and should take into account price inflation, project risk, and the real return that you require. At a minimum, this required rate of return should cover the cost of investment capital to the firm.

4) The number of years (n) over which you would like to estimate project profitability.

In addition, you will need either a “Present Values Table”, on which you can look up Present Value Factors (PVF), or a scientific calculator that will allow you to calculate the Present Value Factors yourself. Both methods are demonstrated below.

Using a “Present Values Table” to determine Present Value Factors

A Present Value Table will allow you to look up Present Value Factors (PVF) for various combinations of n (project year) and d (project discount rate). As an example, look at a CP investment with the following parameters:

1. Initial investment: US$150,000
2. Future savings (FV): Year 1— US$45,000
   Year 2— US$45,000
   Year 3— US$77,000
3. Discount rate (d): 10%
4. Number of years (n): 3

Using the Present Value table attached, look up the Present Value Factors (PVF) for a discount rate of 10% and for project years 1, 2, and 3.

Year 1 PVF: 0.9091 Year 2 PVF: 0.8264 Year 3 PVF: 0.7513

Using the PVFs shown above, the future cost savings for each year can be converted to their present value. These values are then added together to estimate the project's Net Present Value. The initial investment (which is already in present-day dollars) is subtracted from the sum. The result is the Net Present Value of the project.

<table>
<thead>
<tr>
<th>Year</th>
<th>Future Savings</th>
<th>Present Value Factor (10%)</th>
<th>Present Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$45,000</td>
<td>x 0.9091 = $40,910</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>$45,000</td>
<td>x 0.8264 = $37,188</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>$77,000</td>
<td>x 0.7513 = $57,850</td>
<td>$135,948</td>
</tr>
</tbody>
</table>

less: initial investment - $150,000
equals: **Net Present Value** -$14,052

For this example, the NPV is calculated to be -$14,052 which means that the investment is not profitable within three years. A positive value for NPV would indicate that the investment is profitable within three years.
Using a calculator to calculate Present Value Factors

If you do not have a Present Value table available, you can calculate the necessary Present Value Factors yourself as follows:

\[
\text{Present Value Factor (PVF)} = \frac{1}{(1 + d)^n}
\]

where
- \(d\) is the discount rate
- \(n\) is the year number

Using this formula, and a discount rate of 10%, PVFs for years 1, 2, and 3 can be calculated as follows.

- Year 1 PVF = \( \frac{1}{(1 + 0.1)^1} = 0.9091 \)
- Year 2 PVF = \( \frac{1}{(1 + 0.1)^2} = 0.8264 \)
- Year 3 PVF = \( \frac{1}{(1 + 0.1)^3} = 0.7513 \)

These are exactly the same PVFs that you looked up on the table previously. You would use these values to calculate NPV the same way as is illustrated above.